THE PHYLOGENETIC HISTORY OF SPONGES IN PALAEOZOIC TIMES. *Memoirs of the Queensland Museum 44: 410. 1999*:- According to molecular biological analysis, the origin of the phylum Porifera dates back about 800MY. The first sponges were probably aspicular, like the so far oldest definite sponge *Palaeophragmodictyon* from the Late Proterozoic of Ediacara (the even older Duoshantuo fossils may reverse the picture again if the sponge interpretation holds true). Early Cambrian sponge assemblages were dominated by the Hexactinellida, but by the time of the Atdabanian the Pinacophora (Demospongiae/Calcarea-taxon) were also well represented. The Archaeocyatha can be considered as a stem lineage representative of this group. Early Cambrian Calcarea comprise modern-appearing forms as well as the exclusively Palaeozoic Heteractinellida and Polyactinellida, the latter group exhibits triradiate calcitic spicules, which are probably a constituent character of the taxon Calcarea. Within the Demospongiae, the tetraxon is considered the basic spicular symmetry, from which the other spicula-types have derived. Oxyasters from the Early Cambrian, which are in the size range of megasclercs and show well-developed central canals, may have evolved from tetraxone mesotriaenes, whereas the large Middle Cambrian sigmata are probably derived oxeas. This means that the differentiation in mega-and microsclerocytes known from recent demosponges may have taken place at a later stage of poriferan evolution. The first desmata-bearing demosponges ('Lithistida') of the group Anthaspidellidae, Orchocladina-known since the Middle Cambrian-probably originated from reticulated monaxonid precursors close to the Hazeliidae. During the Late Ordovician, the chiastoclones developed from anthaspidellid dendroclones, and the Palaeozoic groups Tricranocladina and Sphaerocladina may have derived from chiastoclonellid ancestors. Contrary to widely accepted hypotheses, there seems to be no direct phylogenetic line from the Orchocladina to the modern Tetracladina, since the origin of tetraxial desmata from anaxial chiastoclones is very unlikely. The earliest true tetraclones with definite axial canals are documented from the Permian *Jereina robusta*, whereas the first phyllotriaenes of the modern spirasterophoran type are known since the Late Triassic. Because of their skeletal architecture, the Palaeozoic Saccospongiidae and Orchocladina, as well as theTricranocladina and Sphaerocladina which most probably evolved from the Orchocladina, are now attributed to the Sigmatophora. The 'megamorine' Saccospongiidae probably originated from a monaxonid group close to the Halichondritidae, but the Palaeozoic heloclones and megaclones as well as the elongate rhizoclones of the Haplistiidae are probably not phylogenetically linked to the modern Megamorina or Rhizomorina. Mesozoic and Recent Rhizomorina are characterised by skeletons of exclusively small rhizoclone desmata with sigmaspires as microscleres. But the sigmaspire is unknown from the fossil record and almost certainly has no connection with the sigmatophoran sigmata, which are known since the Middle Cambrian. At the end of the Permian, the Palaeozoic 'Lithistida', maybe with the exception of the Sphaerocladina, had all become extinct. Against widely accepted ideas, there is probably no phylogenetic link from the Tricranocladina to the modern Corallistidae (Dicranocladina). The Sphaerocladina, which have recently been documented also from the Early Palaeozoic, may have lead to the Mesozoic Neosphaerocladina, but no connection can be documented between these groups and Recent genera sometimes attributed to the Sphaerocladina, such as *Crambe* or *Vetulina*. Lophocalthropses of the Plakinidae first occurred in the Early Carboniferous and are connected by transitional forms to the candelabra of the modern Homoscleromorpha, known since the Early Cretaceous. The characteristic Plakinidae spicules probably originated from the same type of tetraxones, which lead to the first dichotriaenes in the Early Carboniferous. Thus the Plakinidae/ Homoscleromorpha are probably the sister group of the Spirasterophora, to which most modern 'Lithistida' belong. ❐ *Porifera, phylogeny, Palaeozoic sponges, skeletal architecture, Calcarea, Demospongiae, Hexactinellida.*

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